JACC Vol. 19, No. 4
March 15, 1992:771–2

Editorial Comment

Transesophageal Echocardiographic Stress Testing: Feasible, but Place And Accuracy Still in Question*

EDWARD A. GEISER, MD, FACC
Gainesville, Florida

During the past 10 years stress echocardiography has become a popular technique. The versatility of echocardiography allows imaging to be performed during and immediately after exercise as well as during pacing- and drug-induced cardiac stress. Because it is difficult to maintain adequate views during exercise, and to obtain comparable views in the immediate postexercise period, many physicians have advocated the use of pharmacologic agents rather than exercise in echocardiographic stress tests. The most popular agents are dipyridamole, dobutamine and adenosine.

The versatility of pharmacologic stress testing has been previously reported. Two recent studies have shown the value of combining dipyridamole stress testing (1) or cardiac pacing (2) with transesophageal echocardiography.

The present study. In this issue of the Journal, Agati et al. (3) report on the use of dipyridamole as a stress agent for the diagnosis of coronary artery disease utilizing transesophageal echocardiography as the imaging technique. Their objectives were to assess the feasibility, safety and diagnostic accuracy of transesophageal dipyridamole echocardiography. In all 32 patients of this study, transthoracic echocardiography either was not feasible or yielded ambiguous results. The monoplane transesophageal probe was placed in the usual fashion after administration of topical xylocaine and intravenous diazepam for sedation. The dipyridamole stress was produced with low dose administration (0.56 mg/kg body weight) carried out over 4 min. If no wall motion or wall thickening abnormalities were identified during the subsequent 4 min, another 0.28 mg/kg was infused over 2 min followed by 10 min of imaging. At the end of the test all patients received 240 mg of aminophylline intravenously to reverse the effects of the dipyridamole. The authors (3) report a 100% success rate for obtaining adequate transgastric short-axis and long-axis views.

Although echocardiographic stress testing has become popular, it has not enjoyed the widespread acceptance and use accorded to thallium testing. Perhaps the largest frustration in performing stress echocardiography is the inability of the technique to provide good images in all patients. Armstrong (4) suggested that approximately 85% of transthoracic echocardiograms were of good quality and adequate to perform stress imaging. The definitions of one-, two- and three-vessel disease supplied by Agati et al. (3) suggest that "good" or "adequate" should be defined as the ability to visualize with confidence the epicardium and endocardium in all perfusion beds. Perhaps part of the regional variation in the use of stress echocardiography is related to the uneasiness that the physician feels when trying to make important clinical decisions on the basis of images that are difficult to interpret, even if only 15% of patient images are affected.

Feasibility. In the present report Agati et al. (3) look at the feasibility of utilizing transesophageal echocardiography to extend the use of echocardiographic stress testing to patients with inadequate transthoracic studies. Their unstated hypothesis is that transesophageal echocardiography will provide better definition of left ventricular myocardium in all perfusion beds and indeed, adequate images for diagnosis were obtained in all 32 patients. This result is in keeping with the study of Lambertz et al. (2), who obtained high quality diagnostic images in all of their 50 patients. Thus, both of these studies confirm that transesophageal echocardiography can be utilized as the imaging modality and extend the ability to obtain diagnostic images to virtually all patients studied.

Safety. In general, this extension of stress echocardiography to nearly 100% of the patients is accompanied by reasonable safety. In the study of Lambertz et al. (2) and the present study (3), all antianginal medication was discontinued 48 and 24 h, respectively, before testing with no adverse effect on either the hemodynamic stability of the patients or the occurrence of anginal pain during insertion of the probe. No complications were experienced in the present study. Lambertz et al. (3), however, describe discomfort that was poorly tolerated in five patients by the end of the series. In two of their patients discomfort was related to the atrial pacing procedure itself.

Diagnostic accuracy. The accuracy of transesophageal echocardiographic stress testing in predicting coronary artery disease has yet to be determined. In a previous editorial, Armstrong (4) pointed out the difficulties of estimating sensitivity, specificity and predictive accuracy on the basis of feasibility studies. These problems (5,6) apply to the present study (3) as well. The diagnostic accuracy and prognostic implications of transthoracic dipyridamole echocardiographic stress have been investigated in previous series (7–11). One expects that the higher proportion of adequate studies should result in higher diagnostic accuracy when transesophageal imaging is utilized. However, this remains to be proved.

The diagnostic accuracy of transesophageal echocardiography during pacing may be limited if the pacing leads are

*Editorials published in *Journal of the American College of Cardiology* reflect the views of the authors and do not necessarily represent the views of JACC or the American College of Cardiology.

From the Division of Cardiology, University of Florida College of Medicine, Gainesville, Florida.
Address for reprints: Edward A. Geiser, Division of Cardiology, University of Florida College of Medicine, Gainesville, Florida 32610.

0735-1097/92/$5.00

attached to the transesophageal probe because only one scan plane can be interrogated while pacing capture is maintained. Biplane and omniplane probes may lessen this problem.

Interpretation of echocardiographic stress testing is subjective. In each of the published studies utilizing transesophageal echocardiography, interpretation was carried out by expert observers and it is not surprising that even among these experts a third person was required to resolve disagreements. It is important to realize that the sensitivity, specificity and diagnostic accuracy reported in these preliminary studies do not represent the results that can be relied on in any individual laboratory and that the diagnostic accuracy is dependent on the specific experience of the physician interpreting the study.

Exactly how much training is necessary to become proficient in the identification of wall motion abnormalities has not been thoroughly studied. Our own postdoctoral Fellows believe that identifying such abnormalities is one of the more difficult features to learn in echocardiography. Armstrong (4) pointed out that Fellows who had reached level III of training (12) were generally competent to perform stress echocardiography. Physicians who wish to pursue transesophegeal stress echocardiography should also be trained in the transesophegeal techniques. The American Society of Echocardiography (13) recommends that physicians unfamiliar with transesophageal echocardiography should undertake an "intensive block of training" or attend a series of training sessions under the tutelage of an experienced transesophageal echocardiographer. Picano et al. (14) suggest that 100 stress studies interpreted with an expert are "more than adequate" to build the individual learning curve.

Evaluation of wall motion abnormalities. Modern computer review stations enhance the ability to make decisions regarding wall motion abnormality by providing a mechanism for side by side comparison of baseline wall motion with that during stress in the same echocardiographic views. Computer processing may have a more direct impact on diagnostic accuracy in the future. Preliminary reports (15) with automatic quantification systems during stress echocardiography are encouraging in this respect. Other methods to identify both the epicardium and the endocardium (16,17) are under development and would take advantage of both regional wall motion and wall thickening to provide diagnostic criteria for induced ischemia. Discussion continues regarding the best means to express regional dysfunction. Methods that analyze left ventricular shape over the course of systole (18) may prove preferable to methods that look at motion toward the centerpoint of the left ventricle or methods that look at motion perpendicular to a mean wall position.

Conclusions. Studies utilizing transesophageal echocardiography as the imaging tool for evaluating the left ventricle under stress have shown both the feasibility and the relative safety of the technique. However, the technique seems most applicable as an adjunct when transthoracic echocardiography provides unacceptable visualization of the vascular beds. How important this tool will become must be determined by the risk/benefit, cost/benefit and comfort/benefit ratio to patients.

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